The
AMERICAN JOURNAL
of
MEDICAL TECHNOLOGY

VOLUME 7 MARCH, 1941 NUMBER 2

BLOOD GROUPING TESTS IN RELATION TO TRANSFUSION*

By ALEXANDER S. WIENER, A.B., M.D.

From the Transfusion Division of the Jewish Hospital of Brooklyn, New York, and the Serological Laboratory of the Office of the Chief Medical Examiner of New York City.

Simplifications in the technique of blood transfusion and to some extent the present widespread adoption of "blood banks" have increased the frequency with which this important therapeutic procedure is used. It is the purpose of this paper to present a few of the recent advances, but I shall begin with a number of general considerations, concerning which a certain amount of uncertainty still seems to exist, if one is to judge from some of the papers that have been published as late as the current year.

Firstly, I should like to urge those of you who still use the Jansky or Moss numberings to give them up and adopt the International Nomenclature (cf. table I). The existence of two systems of numberings has resulted in confusion and has been responsible for transfusion accidents. At any rate, no advantage is derived by giving

* *Read before the Eighth Convention of the American Society of Medical Technologists, New York, N. Y., June, 1940.*

numbers together with the letters; indeed, designations such as AII may lead to confusion with the subgroup A_2.

TABLE 1

CLASSIFICATION AND COMPOSITION OF THE LANDSTEINER BLOOD GROUPS

International Nomenclature	Jansky Numbering	Moss Numbering	Cells (Agglutinogen)	Serum (Agglutinin)
O	I	IV	—	α and β
A	II	II	A	β
B	III	III	B	α
AB	IV	I	A and B	—

The phenomenon of isoagglutination, upon which the division of human beings into four blood groups, O, A, B and AB, depends, has, as you know, been explained by Landsteiner, the discoverer of the blood groups, by postulating the existence in the erythrocytes of two agglutinogens, designated by him as A and B, and of two corresponding agglutinins, α(or anti-A) and β(or anti-B), in the serum. According to Landsteiner's law, those agglutinins (and only those) are always present in the serum for which the corresponding agglutinogens are lacking from the cells (cf. table 1). This statement, however, does not apply to infants only a few months old. While the agglutinogens begin to appear in the erythrocytes during fetal life, so that the group of newborn infants can, as a rule, be determined by the reactions of the red cells in standard sera, the isoagglutinins are often not fully developed until the end of the first year of life. Where the newborn has isoagglutinins in its serum, these as well as any other antibodies that may be present have been derived from the mother by placental transfer. The titer of such agglutinins is low, about one-tenth the titer of the maternal agglutinins, and they usually disappear by the seventh to tenth day of life. Later the infant gradually elaborates its own agglutinins. I may call your attention also to the observation that infants may have isoagglutinins in their sera as a result of transfusion. For example, I observed one infant of group O with rather strong α and β agglutinins which evidently were acquired through several previous transfusions of group O blood.

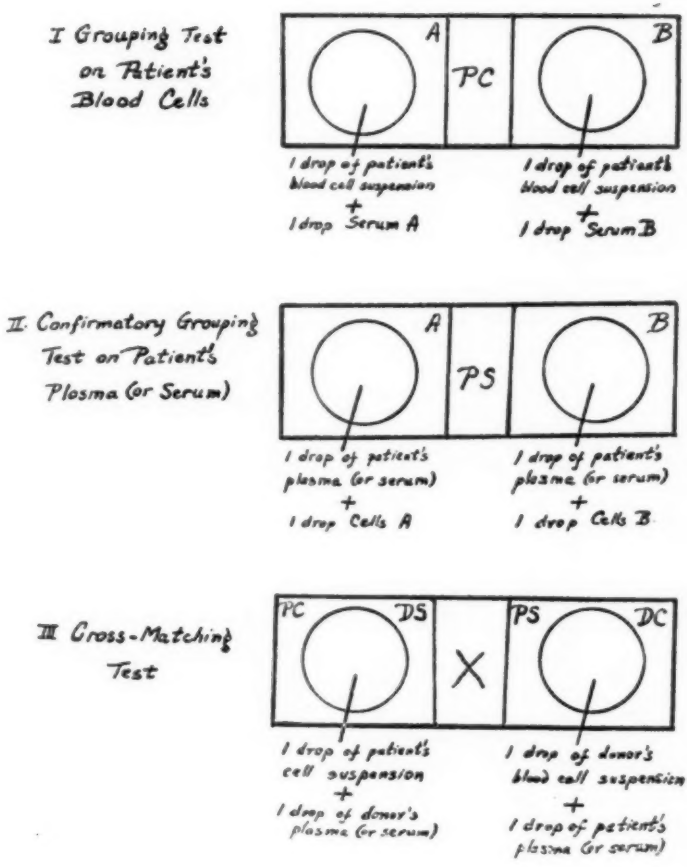

Fig. 1—Diagram illustrating technique of grouping and cross-matching bloods of patient and donor, before blood transfusions.

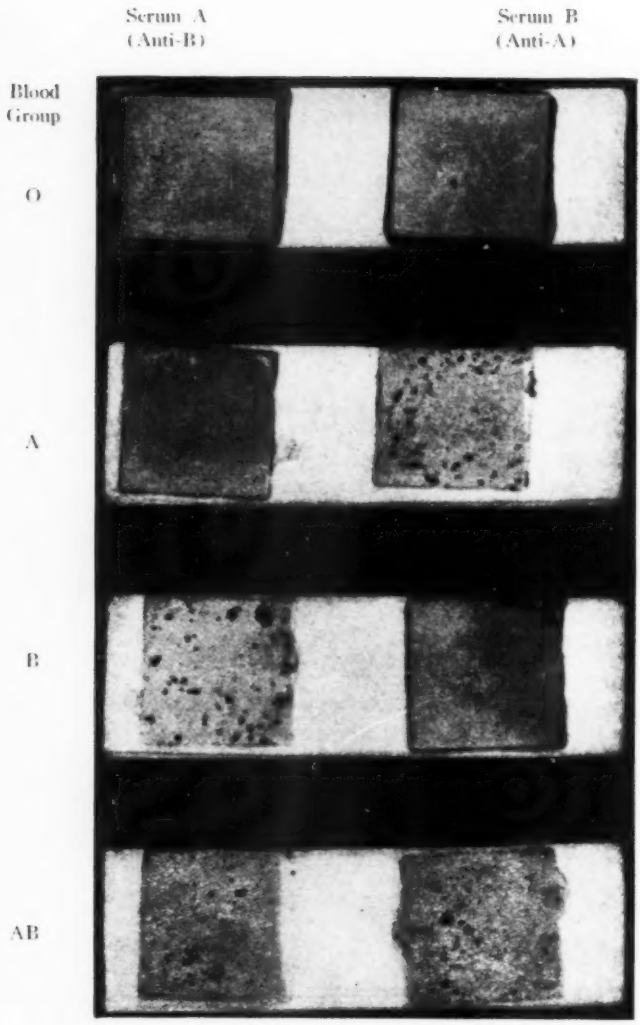

Fig. 2—Blood grouping on glass slides (actual size).

Reproduced by permission from Wiener's "Blood Groups and Blood Transfusion." C. C. Thomas, 2nd edition, 1939.

Except in infants, in blood grouping tests the reactions of an individual's serum serve as a valuable check on the reactions of the red cells, and in all such tests, where time permits, both cells and serum should be examined (cf. figs. 1 and 2).

For the proper execution of the blood grouping tests it is essential to have on hand high titered sera of group A (containing β agglutinin) and group B (containing α agglutinin). These should be obtained from individuals who are known from preliminary tests to have isoagglutinins of satisfactory potency in their sera, rather than by taking group A or group B individuals at random or by pooling sera remaining from Wassermann tests. The reason for this is that only about one in twenty individuals, on the average, have strong enough sera to give distinct reactions with bloods containing weakly reacting agglutinogens, such as exist particularly in group A and group AB.

You all are familiar with the existence of two sorts of agglutinogen A[1] giving rise to two subgroups, A_1 and A_2, in group A, and to two subgroups, A_1B and A_2B, in group AB, the bloods containing agglutinogen A_2 reacting more weakly with anti-A sera than bloods of subgroups A_1 and A_1B. As the reactions are weaker for blood of group AB than blood of group A, the relative agglutinability of the four sorts of blood with A agglutinogen in anti-A sera is as follows: $A_1 > A_1B > A_2 > A_2B$. Accordingly, the mere fact that an anti-A serum gives strong reactions with a particular group A or group AB blood is not proof that it will distinctly agglutinate all other bloods containing the agglutinogen A. The difficulty is greatest with subgroup A_2B, and many of you have probably met donors who bear the tale of woe that at one hospital they were said to belong to group B, at another to group AB, so that they don't know what the actual situation is. In these instances, as a rule, the correct group is AB (subgroup A_2B), and if such donors are used for group B patients a hemolytic reaction might result.

I am accustomed to keep on hand, in addition to potent human

[1] The so-called agglutinogen A_3 is so rare that it will hardly ever have to be taken into account in practical work.

A and B sera, anti-sera prepared by immunizing rabbits with human group A and B blood. While for ordinary grouping the usual A and B sera are sufficient, the immune sera proved to be valuable in the rare cases where the human sera at hand gave some difficulty. The immune sera cannot be used directly because they contain in addition to the specific anti-A or anti-B agglutinins, antibodies for human blood in general. Before use such sera must be diluted with normal saline solution and then treated with washed and packed human blood cells not containing the specific agglutinogen in question in order to absorb out the unwanted species agglutinins.

When individuals with high titers of isoagglutinins are not available whose sera can be used for blood grouping, it may be found advantageous to take blood from patients who have recently had injections of horse serum, since Davidsohn has reported that such injections cause a marked rise in the titer of the isoagglutinins. With the advent of sulfapyridine therapy for pneumonia, however, such patients are now less frequent. Moreover, when taking blood from patients for the preparation of grouping sera, one must remember that when the sedimentation rate is high, the serum will exhibit potent rouleaux-forming properties. Pseudoagglutination based on this phenomenon is easily avoided, however, by diluting the serum with an equal volume of saline solution before use. When immune sera are used for grouping, on the other hand, care must be taken that the species agglutinins are absorbed as completely as possible by using an excess of absorbing blood, or false agglutination reactions will result. For this reason, the use of immune sera for routine blood grouping tests requires more experience than the usual grouping sera.

In most institutions only donors of the same group as the patient are used for blood transfusions. Some hospitals, however, still use group O individuals as "universal donors" for patients belonging to one of the other three groups. This principle was first introduced by Ottenberg, who found that the transfusion of incompatible cells, for example, A, B or AB blood into a group O patient, is far more dangerous than the transfusion of incompatible plasma, such as the injection of group O blood into a patient of group A, B or AB. The explanation usually given is that the incompatible plasma

is diluted so much in the patient's circulation that the foreign agglutinins practically lose their power to hemolyze the patient's cells. Levine and Mabee and Coca have pointed out, however, that the use of universal donors is unsafe when their sera contain potent isoagglutinins, and a number of transfusion fatalities have been ascribed to the use of such "dangerous universal donors."

This question has recently been revived in a different form in connection with the use of human plasma and serum instead of whole blood for transfusions. A number of workers have asserted that under the principle enunciated by Ottenberg, the groups can be disregarded when human plasma or serum is injected. However, in the speaker's opinion this has the same objection as the indiscriminate use of universal donors, and there should be no great difficulty in keeping the plasma classified into groups, especially in institutions where the plasma is obtained from old "bank blood." To take care of this objection, Edwards, Kay and Davie suggest that equal parts of group A and group B blood be pooled, and then the plasma be separated from the cells which will absorb out the isoagglutinins. Plasma of group AB would be ideal for all patients, but, of course, is not readily obtainable. Levinson and Cronheim have reported that merely pooling together sera of various groups lowers the titer of the isoagglutinins markedly, and these workers that such pooled serum can be used for all patients regardless of their blood groups. At any rate, pooling would serve to dilute those sera which contain potent agglutinins. While this paper was in press, there appeared a report by Witebsky in which was advocated the addition of purified solutions of group A substance to blood from group O donors to be used for transfusions to group A patients. In cases where this ingenious idea was carried out, a marked drop in the titer of the α isoagglutinins in the donor's blood was demonstrable.

An idea which seems to be prevalent is that the transfusion of incompatible blood is invariably followed by a fatal reaction. It is true that once a typical hemolytic reaction with anuria has set in the prognosis is grave, as about half of the patients with this complication fail to recover. Still, it is possible for a patient to receive incompatible blood without the occurrence of any noticeable unto-

ward symptoms[2]. In a case recently seen by the speaker, a woman of group O, ill with chronic leukemia, was given three transfusions in rapid succession of group B blood, totalling 1500 c.c., through an error in blood grouping. Nevertheless, there was no untoward reaction after the transfusion, the hemoglobin rose from 40 to 69 per per cent, and the patient stated that she felt stronger. However, the hemoglobin promptly dropped back to 40 per cent again, and when the patient's blood was retested preliminary to another blood transfusion the error in grouping was discovered. Tests with anti-B serum then revealed that all the group B blood that had been

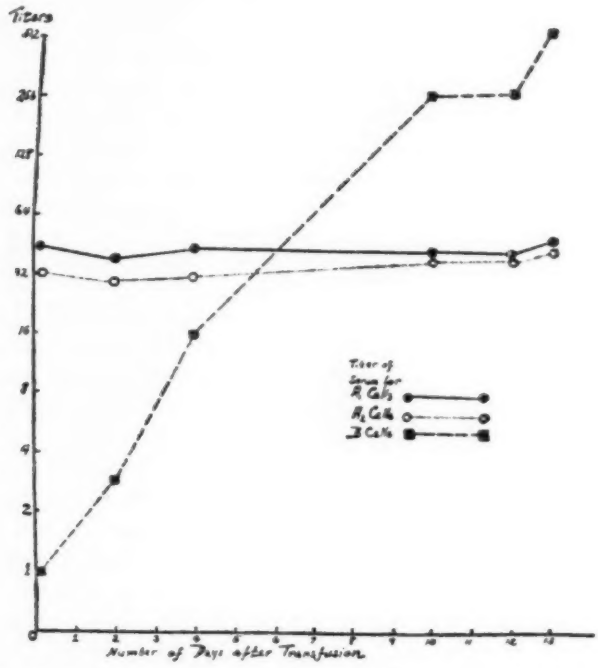

Fig. 3—Changes in isoagglutinin titers of the serum of a group O individual resulting from the transfusion of group B blood.

[2] Cf. Townsend and Coca, Grove and Crum, Burnham.

received at the previous transfusions had been eliminated from the patient's circulation, so that these transfusions, while apparently not harmful, had been of only very transient benefit, at best. The cause of the error in grouping was a temporary abnormal agglutinability of the patient's red blood cells, possibly related in some way to her clinical condition. Moreover, before the transfusions of group B blood were given, careful cross-matching tests had been made but were negative, so that there had evidently been little or no anti-B agglutinins in the patient's serum at that time, and this probably had some bearing on the absence of any untoward reaction. As has already been pointed out, the B blood was eliminated from the patient's body, but its hemolysis was too gradual to give rise to noticeable symptoms. At the same time the body began to elaborate potent anti-B agglutinins as an immune response to the injection of foreign B blood, and one week after the transfusions of group B blood the titer of the anti-B isoagglutinins was very high. At the peak of this immunization process, another transfusion of group B blood would most likely have given rise to a serious or fatal reaction. In figure 1, the immunizing action of a transfusion of 500 c.c. of group B blood into a group O patient is illustrated. It will be seen that this transfusion had no effect on the titer of the anti-A isoagglutinin, which remained rather constant at about 30, while the titer of anti-B isoagglutinin rose from a low value of 1 immediately after the transfusion to the high level of 500, about twelve days later.

These observations serve to explain some hemolytic transfusion reactions which were encountered in the old days, when the only preliminary serological test made by many workers was a direct matching of the bloods of patient and donor. In such a case[3] a transfusion would be given from an apparently compatible donor without any evident untoward reaction. Later when another transfusion was required, the same donor was used without repeating the direct matching, since it was reasoned that the donor had been satisfactory previously and should be suitable again. When a serious reaction resulted following the second transfusion, this was sometimes blamed on a "change" in the group of the patient or

[3] Cf. Thalhimer, Wiener and Peters.

donor, whereas one was really realing with an immunization reaction to blood of an incompatible group.

You are aware that there are other individual differences in human blood, independent of the four blood groups. These, like the blood groups, depend on the presence in the erythrocytes of various combinations of agglutinogens, two of which, the agglutinogens M and N, have been rather extensively studied. These two agglutinins give rise to three types, M, N and MN, and individuals do not exist whose blood lacks both agglutinogens. Since the three types are independent of the blood groups, the four agglutinogens, A, B, M and N, together give rise to 12 classes of individuals, namely, OM, ON, OMN, AM, AN, AMN, etc. If the subgroups, A_1 and A_2, A_1B and A_2B, are taken into account, the number of subdivisions of human blood possible is increased to 18.

The injection of type M blood into type N patients of the homologous blood group does not give rise to transfusion reactions, since with only extremely rare exceptions isoagglutinins for M and N are not present in human serum[4]. (The reagents for testing for M and N are prepared in a similar manner to the immune sera for A and B, that is, by immunizing rabbits and then absorbing the diluted immune sera to remove the species agglutinins.) Several writers have asserted, however, that repeated transfusions of type M blood into type N individuals, or vice versa, are dangerous because of the formation of immune anti-M or anti-N isoantibodies, just as the injection of A or B blood into group O individuals can stimulate the production of immune isoantibodies for A and B, respectively. As a matter of fact, despite a personal experience with almost 5000 transfusions, the speaker has never observed the occurrence of an immunization against M or N or a transfusion reaction directly attributable to these agglutinogens; nor has such a case been reported in the literature.

However, it is well established that hemolytic reactions can result on rare occasions following transfusions of blood of the proper group, particularly in patients receiving repeated transfusions. Six

[4] Only three instances have been found with anti-M isoagglutinins, none with anti-N, though hundreds of thousands of individuals have been tested to date.

TABLE 2

COMPARISON OF BLOOD SERA FROM THREE PATIENTS†, WHO HAD REACTIONS FOLLOWING REPEATED TRANSFUSIONS, WITH AN ANTI-RHESUS IMMUNE RABBIT SERUM.

(Combined Results of a Number of Experiments)

Blood Specimen No.	Group and Type	Agglutination Reactions With				
		Anti-Rhesus Immune Rabbit Serum*	Patient No. 1 Group O	Patient No. 2 Group A	Patient No. 3 Group A	Anti-P Serum
1.	OM	neg.	—	—	—	++±
2.	OM	pos.	++±			
3.	OM	pos.	+++		++±	—
4.	OM		+++		++	+±
5.	OM	pos.		++±		
6.	OM	pos.		++	+++	
7.	OM		+++	++±	+++	
8.	ON	pos.	++±			+±
9.	ON	pos.	++±	++	++	+±
10.	ON	pos.	+++			+±
11.	ON	neg.	—	—	—	++
12.	ON		++	++	++±	+±
13.	OMN	pos.	+++		++±	
14.	OMN	pos.	++±			
15.	OMN	neg.	—	—	—	—
16.	OMN	neg.	—	—	—	
17.	OMN	pos.	++±	++	++	+±
18.	OMN	pos.	+++	++		—
19.	OMN		+++	++		—
20.	OMN		+++	+++		+
21.	OMN		—	—		
22.	OMN		+++	++±		
23.	OMN		+++	++		
24.	OMN			—	—	
25.	A_1M			++	++	
26.	A_1M			++	++	+±
27.	A_1M			—	—	—
28.	A_1N			—	—	
29.	A_1MN			++	++±	+±
30.	A_1MN			++	+±	++
31.	A_1MN			++	++	
32.	A_1MN			++	++±	+±
33.	A_2MN			++±	++	+±
34.	A_2MN			—	—	—
35.	A_2MN			++	++±	
36.	A_2MN			++	++	+±

* Diluted 20 times with saline solution and then absorbed with Rh negative blood.

† Wiener and Peters.

such instances have been observed by me personally; in three of these, the reactions caused the deaths of the patients. In three of the six cases, serological investigations were carried out in an attempt to determine the cause of the reactions, and the results of these studies have been reported in detail in a paper now in press, written in collaboration with Dr. H. R. Peters. In these cases it was found that individual blood differences with respect to a special agglutinogen, different from any of the agglutinogens A, B, M and N, were responsible for the reactions. This agglutinogen proved to be the same as the one recently discovered by Dr. Karl Landsteiner and the speaker, and designated as Rh (cf. table 2). Only about one-seventh of human beings lack this particular agglutinogen, according to the tests made on a series of almost 200 persons. The three patients in question possessed Rh negative blood, (the uncommon type) and when transfused with Rh positive blood (the common type) produced anti-Rh antibodies, so that additional transfusions of blood containing the Rh agglutinogen eventually gave rise to hemolytic reactions. Strangely enough, the anti-Rh isoantibodies in the patient's serum are difficult to demonstrate as they behave like weak cold agglutinins. The speaker has found that by chilling the mixture of patient's serum and donor's cells, and then centrifuging the mixture in the cold, the reactions are intensified and become as distinct as the common isoagglutination reactions.

Instances have also been observed of hemolytic reactions following transfusions of blood of the homologous group where the patient had never previously received a blood transfusion. Wiener and Peters have shown that all the cases of this sort that have been reported occurred in post-partum or intro-partum patients. To explain these reactions, one can postulate, as Levine and Stetson were the first to suggest in their own case, that the blood of the mother lacks one of the special agglutinogens, such as Rh or P, that is present in her husband's blood. The fetus inherits the agglutinogen from its father and while in utero stimulates the production of isoantibodies in the mother[5]. When this woman needs a

[5] A sentence in the summary of the paper by Wiener and Peters has been taken, I am informed, as a claim for priority concerning this idea. I wish to state that this was not intended, and the statement was meant to refer to the generalization of this concept. That this was first advanced by Levine and Stetson is clearly stated in the text of the paper (cf. page 2316).

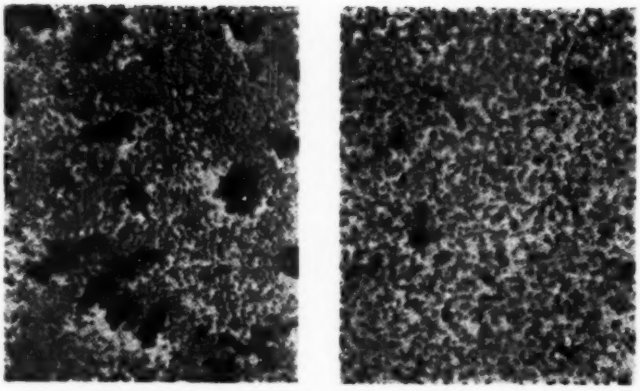

Fig. 4—Agglutination reactions with anti-M serum following blood transfusions. *Left:* Patient type MN and donor type N. The agglutinated cells here are the patient's, the unagglutinated, the donor's. *Right:* Patient type N and donor type MN. Here the agglutinated cells are the donor's, the unagglutinated, the patient's.

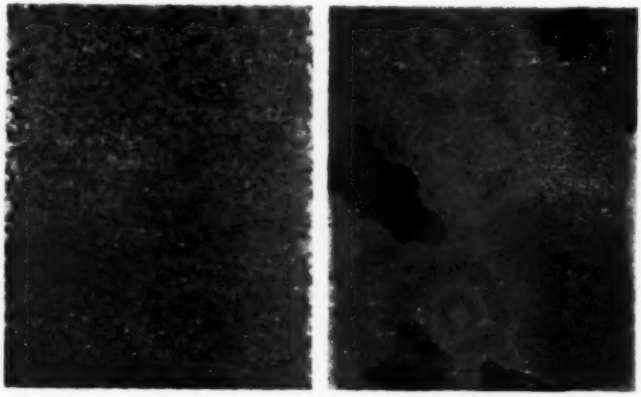

Fig. 5—Microscopic appearance of typical agglutination tests. *Left:* Negative reaction—each red blood cell is separate and distinct. *Right:* Positive reaction—the red blood cells are agglutinated together in large clumps with only rare free cells. (Wiener's "Blood Groups and Blood Transfusion." C. C. Thomas, 1939.)

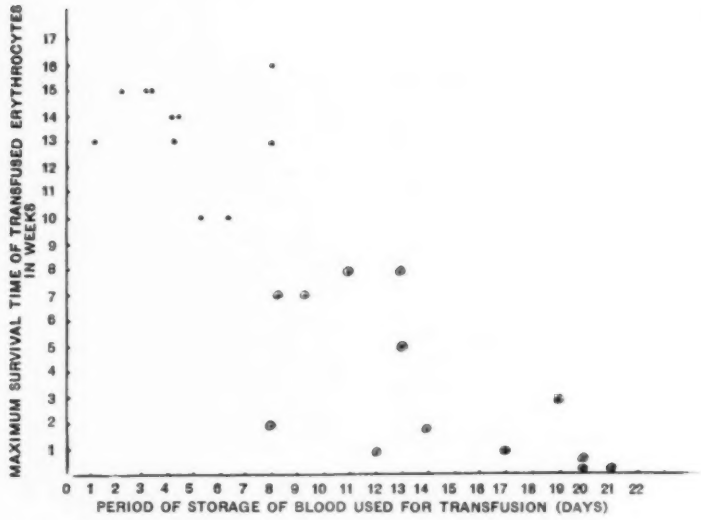

Fig. 6—Scattergram of results of transfusions of preserved blood in 24 patients. Circle around dot indicates that serum of patients after transfusion was icteric.

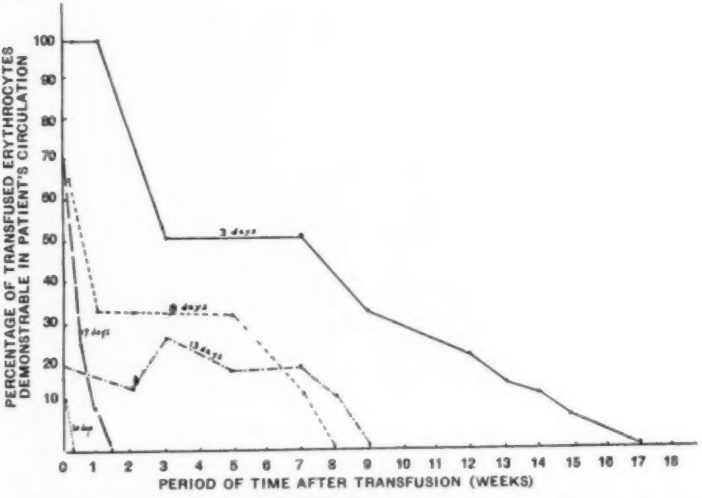
PERCENTAGE OF TRANSFUSED ERYTHROCYTES DEMONSTRABLE IN PATIENT'S CIRCULATION
PERIOD OF TIME AFTER TRANSFUSION (WEEKS)

Fig. 7—Percentage of translated blood cells surviving at varying periods following transfusion. (Five illustrative cases. Period of storage in days of blood used for transfusion is indicated on each curve.)

transfusion, the person usually selected as a donor is the husband, provided he belongs to the same blood group, and then a hemolytic reaction results.

Two questions are raised by these observations. One is why such reactions do not occur more frequently. To this the only answer I can offer is that, as a rule, the body, so to speak, does not recognize the distinction between Rh positive and Rh negative bloods, any more than it does between type M, type N and type MN bloods, and only for rare Rh negative individuals does Rh positive blood act as a stimulus for antibody production. Another question is how it is possible for severe and fatal hemolytic reactions to result, when the agglutination reactions in vitro are so weak and occur only in the cold. Possibly the agglutinins detected in the test-tube are only an indicator of some supplementary, more subtle mechanism which is brought into play in the body to cause hemolysis[6].

A pertinent question is what role the subgroups of groups A and AB play in transfusion reactions. In the speaker's experience these have proved to be less important than for instance the agglutinogen Rh, and despite claims to the contrary, no hemolytic reactions have yet been reported that can be definitely blamed on subgroup differences. However, two cases have recently been seen by the speaker which prove that on rare occasions A_1 blood can act as an antigen for A_2 individuals. Accordingly, the simplest procedure is to disregard the subgroups except in those instances where the cross-matching tests reveal the presence of α_1 or α_2 agglutinins in the patient's serum, and in such cases to use blood donors of the same subgroup as the patient.

The fact that the properties M and N do not influence the result of blood transfusions, makes these agglutinogens useful for following up transfusions, as was done also by Ashby by the use of blood of group O for transfusions to patients of the other groups[7]. The

[6] Antibodies fixed to the reticuloendothelial cells, for example.

[7] This method was first applied by Landsteiner, Levine and Janes to transfusions of fresh blood. These workers transfused a patient of type M with type N blood and were able to detect the transfused cells in the patient's circulation for 14 weeks.

two sorts of red cells in a mixture of OM and ON bloods can be separated by adding anti-M serum, which will cause the agglutination of the OM cells while the ON cells remain unaffected. Similarly, if an AM patient is given AN blood, for example, the fate of the donor's cells in the patient's circulation can be determined with the aid of anti-M and anti-N sera (cf. figs. 4 and 5). This method has been applied by Wiener and Schaefer for evaluating transfusions of bank blood. While fresh blood survived for periods up to 120 days, the survival time of preserved blood decreased about 6 days for each day of storage, so that transfused blood that had been kept 20 days in vitro was hemolyzed and eliminated from the body within a few hours (cf. figs. 6 and 7)[8]. On the basis of their findings, Wiener and Schaefer advise against the use of bank blood more than one week old for transfusions.

Clausen has applied anti-M and anti-N sera to the study of the results of intraperitoneal transfusions. This method of transfusion has been advocated for inexperienced transfusionists who encounter difficulty in properly entering the veins of infants. Clausen found that the donor's red cells pass rather slowly into the infant's circulation from its peritoneal cavity and continue to do so for several days. Accordingly, aside from their dangers, intraperitoneal transfusions are less effective than intravenous transfusions in conditions, such as hemorrhage, where a large supply of circulating erythrocytes must be supplied within a short space of time.

The same method can be used for investigating reactions encountered after transfusions of blood of the correct group, provided that the patient and donor belong to different M-N types. If the donor's cells have disappeared, then one is dealing with a hemolytic reaction, possibly due, for example, to intragroup blood differences based on the property Rh.

From the foregoing may be seen that some progress has been made during recent years in the understanding of the causes of hemolytic transfusion reactions. It still may be mentioned that a considerable decrease in the incidence of chills and fever has been achieved as a result of the discovery by Seibert of the part played

[8] Similar results have been obtained by Levine (personal communication) and others.

by pyrogens sometimes present in the distilled water used for preparing the saline and citrate solutions. Some of the problems relating particularly to intragroup hemolytic reactions are still unsolved. In addition it may be stated that the fundamental basis of the nephritic symptoms occurring in hemolytic reactions is not clearly understood, though the importance of the pH of the urine has been established by the investigations of Baker and Dodds, DeGowin et al. and others. For the solution of these and other problems, such as the cause of urticarial and other allergic reactions, we can look to the future, when the continued use of blood transfusions for therapy will further enlarge our experience and understanding.

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Addendum

During the past year, the writer has seen ten cases of hemolytic reactions following transfusions of blood of the correct group, in addition to the four cases previously reported with Peters. In four of the ten new cases, irregular isoantibodies were demonstrable in the patients' sera. Three of these four sera behaved alike, giving reactions corresponding to the agglutinogen Rh, of Landsteiner and Wiener, so that the hemolytic reactions in these cases were due to the Rh factor. In the fourth case with demonstrable isoantibodies, the reactions differed from those of standard Rh sera, though there was a correlation between them. A summary of all the cases of intragroup isoimmunization with demonstrable isoantibodies, that have been encountered by the writer to date (including those reported with Peters) revealed that in seven the Rh agglutinogen was involved, in two the agglutinogen A_1 and in one the agglutinogen P.

The six cases without demonstrable isoantibodies offered a special challenge. In view of the findings in cases with demonstrable isoantibodies, it seemed plausible that most of these hemolytic reactions were due to factor Rh. That this surmise was correct was indicated by the fact that all six patients were Rh negative. Moreover, deliberate transfusions of Rh negative blood gave satisfactory clinical results, while transfusions from donors not selected with regard to the Rh factor resulted in hemolytic reactions.

The ten new cases, like those previously reported, fall into two categories: in one, the patients received repeated blood transfusions, the earlier transfusions serving to immunize the patients against Rh

antigen and the later transfusions causing hemolytic reactions; in the other group, the hemolytic reactions occurred at the very first transfusion. Every instance of the latter type occurred in an intrapartum or postpartum case. It is advocated, therefore, that for such patients Rh negative donors (of the same group as the patient) should be used whenever possible. In general, a "safe universal donor" would be an individual of group O, Rh negative, with only low-titered isoagglutinins in his serum.

These findings supply an explanation for the erratic clinical results sometimes observed when treating diseases which call for repeated blood transfusions. Careful selection of donors, paying special attention to the Rh factor, may produce more satisfactory clinical results in such instances.

Recently, Levine and Katzin have pointed to an apparent relationship between intragroup isoimmunization in pregnancy and complications such as toxemia, eclampsia, etc. This is a revival in new form of a long abandoned idea that such disorders were due to incompatibility between the groups of mother and fetus (Ottenberg, Hirszfeld, etc.) The present writer has also observed an apparent correlation between pregnancy complications and isoimmunization, but has refrained from drawing definite conclusions for the following reason: All the cases studied were detected because hemolytic reactions followed blood transfusions; in patients without complications transfusions are not required, so that isoimmunization would not be detected even if it occurred in these cases also. The report by Levine, Katzin and Burnham on the relationship of isoimmunization in pregnancy (particularly against Rh factor) and erythroblastosis foetalis seems quite convincing.

THE ROLE OF A TECHNICIAN IN AN ALLERGY CLINIC*

By MOLLIE L. HILL

Laboratorian in Bacteriology, Allergy Laboratory and Clinic
U. S. Veterans Administration, Pittsburgh, Pa.

The purpose of this paper is to discuss briefly the part played by a laboratory technician associated with an allergy laboratory and clinic and to indicate briefly the preparation and qualifications necessary in that connection.

Allergy is a comparatively recent addition to the field of medical specialties, whereas only a few years ago this branch of medicine was still considered in the experimental stage. At present it has come of age. It has been introduced as a subject of study in the curriculum of most medical schools. Most large hospitals and medical centers have divisions and laboratories devoted to the study and treatment of patients suffering with allergic disorders. Medical literature is replete with contributions to this subject. Because of this growth, we have seen the addition to laboratories of technicians whose training qualifies them in this field. As a preliminary requisite for qualification for this work, a technician should have had experience in a general clinical laboratory and some knowledge of general medical laboratory tests. Perhaps a technician who has had particular training in chemistry will find his work easier because the preparation of extracts involves to some extent a knowledge of this subject.

It is my purpose to review briefly what the responsibilities of a technician working in an allergy clinic might be and indicate the nature of the tests that he may be called upon to do. These responsibilities fall under three general headings:

A. Preparation of extracts used in the diagnosis and treatment of allergic patients.

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* *Read before the American Society of Medical Technologists, New York City, June, 1940.*

B. Diagnostic tests employed in the management of allergic individuals.

C. Preparation of treatments.

A. *Preparation of Extract:* I do not intend to discuss here in detail the various methods of preparation of extracts of allergens employed in the diagnosis of allergy. There are many methods of preparation. These depend to some extent upon the individual preferences as well as on the technique which will be employed in testing the patient. With the exception of instances of contact dermatitis, where the allergic reaction is due to sensitivity to the oily fraction in a substance, most allergic patients are sensitive to the protein fraction of a given food or inhalant. For this reason, in preparing an extract of a given substance, we try to extract the protein fraction of that substance. To do this it is, therefore, essential first to obtain the substance to be extracted. If the substance is a solid, it is ground into fine particles and the fat is removed by washing with ether. After the ether is decanted the material is dried. Tuluol is added to it as a preservative and some form of buffered saline solution is used for extraction purposes. After several days the toluol is removed and the extracting fluid containing the active principal of the substance is separated. Because many of these solutions contain irritating coloring matter and other materials, it is wise in many instances to dialyse the fluid. The final product is concentrated by evaporation and rendered sterile by passing it through a Berkfeld or Seitz filter. A nitrogen determination is made on the resulting fluid for standardization purposes. If the extract is to be used for scratch tests, glycerine is added as a preservative. Otherwise the extract is bottled in vials, diluted according to experience and the final product is used for intradermal testing not before it is cultured and found to be bacteriologically sterile.

This process is somewhat modified in the case of juicy vegetables and fruits.

It has been found that inhalants such as dust, animal danders, wool, and silk will last a long time and deteriorate slowly. On the other hand, meats, cereals, and fish do not last longer than two or three months. For this reason they should be freshly prepared at least twice a year. Because of the rapid deterioration, it is well to

preserve these extracts in the ice box.

Whenever possible it is also well to biologically assay these extracts against known cases of sensitivity so as to make sure that one is using a potent extract. A great deal of the results to be derived from skin testing will depend on the care that is taken in the preparation of the extract. Even under the best circumstances, results to be obtained from skin tests are not final and must be interpreted carefully in the light of clinical findings.

B. *Diagnostic Tests:* In many clinics it is the duty of a technician to skin test allergy patients and to perform diagnostic tests on patients, under the immediate supervision of a physician whose responsibility it is to read and interpret these tests. The tests briefly can be grouped under:

1. Direct skin tests which include the scratch and intradermal and patch tests.
2. The indirect skin test or passive transfer test.
3. The mucous membrane test which includes the nasal and ophthalmic test.

The purpose of these tests is to determine whether or not the patient reacts to a given substance. Briefly, the technique of these tests is as follows:

The scratch test involves a superficial abrasion, ⅛ inch long, produced by a small needle, taking care not to draw the blood. If the allergen is a dry powder, one drop of tenth normal sodium hydroxide is placed on the scratch, mixed with the powder and then allowed to dry. If allergen is liquid or paste it is applied directly to the scratch. The scratch test is by far safer in the hands of the inexperienced because it is less likely to lead to constitutional reactions. On the other hand, it is not as accurate as intradermal tests which are simpler, easier to perform, cleaner, and less painful.

Intradermal Test. From a tuberculin syringe with needle, 26 gauge, ⅜-inch long, is introduced intradermally (between the layers of the skin) a small amount, about 0.01 cc, of the allergen. Tight sleeves or anything that might constrict the circulation are avoided. The reactions of both scratch and intradermal tests are read at the end of fifteen minutes for erythema, pseudo-pods, and wheals at the site of injection.

The passive transfer test is used in instances where the individual has a generalized dermatitis and there is no skin area left for the performance of direct skin tests, or in the testing of nervous individuals, or infants, or in instances where it is desirable to corroborate the finding of a direct skin test. When passive transfers are indicated the blood serum from a sensitized person is introduced into the skin of a non-sensitized recipient. The latter area becomes locally sensitized upon contact with the offending allergen.

The opthalmic test is performed by placing in the conjunctival sac a drop of the allergen or a small amount of the dry raw material. A positive reaction is noted within five to fifteen minutes characterized by redness of the eye, lacrimination and itching. A marked positive reaction is promptly controlled by epinephrine applied locally.

The mucous membrane tests are employed also for corroboration purposes.

C. *Preparation of Treatments:* In many clinics it becomes the duty of the laboratory technician to prepare or administer, under the supervision of the physician in charge, vials of treatment. Each vial contains one dose for treatment of whatever condition the patient has. Thus in the case of hay fever, the patient may frequently be given a series of vials, each containing a treatment, to be taken to the family physician for this purpose. In this connection it is well to remember that these doses are prescribed by the physician and are based either on various amounts of certain dilutions of the extract, as pollen extract, or various amounts of extracts of different nitrogen concentration. In this connection it is important to bear in mind that a mistake in the calculation or the pipetting of the amount of extract may prove disastrous to the patient, because an unusually large dose, administered to a patient before that patient is ready to tolerate that dose, may result in a constitutional reaction which may even be fatal. For this reason, too much emphasis can not be placed on the responsibility of the technician in the care which he must exercise in preparing these extracts. Familiarity with and constant use of the tables of dilutions and standardizations are important in preparing the individual doses and vials for various clinics.

The technician must be acquainted with the symptoms of a constitutional reaction so that he can be on the lookout for them whether the patient is in a clinic or a doctor's office. A general restlessness and itching of the nose and palms are some of the first symptoms of a constitutional reaction. Complaints of tightness of chest, coughing and wheezing, erythema and edema at the site of injection, swelling of face, hands and fingers will follow if medication is not administered. The patient should always wait for twenty or thirty minutes after an injection and if he develops such symptoms a physician should be called so that proper treatment may be administered.

Finally, it occasionally becomes important to determine the presence of associated antibodies in the study of the mechanism of certain cases of allergy. For this reason, a technician should be able to perform precipitin tests and help in the determination of anaphylactic antibodies. Precipitin tests are done to determine the precipitin content of the patient's serum. The combination of serum containing antibodies with the antigen will, under suitable conditions, result in the formation of a precipitin.

Into six test tubes (Kahn size) place one drop of immune serum by means of a capillary pipette. The immune serum is overlayed with various dilutions of antigen. After five to thirty minutes (at room temperature) a distinct white ring at the point of contact will form. The highest dilution giving a positive reaction is the titre of the serum.

The determination of anaphylactic antibodies is made by attempting to induce anaphylactic shock in a guinea pig by injecting it intraperitoneally with the serum of a sensitive patient. Sometime later the allergen to which the patient is sensitive is injected intravenously into the guinea pig and if anaphylactic shock is produced, we assume that anaphylactic antibodies against the allergen were present. The Dale-Schultz technic is still another method with which an allergy technician should be acquainted in order to help him determine the presence of anaphylactic antibodies in a given serum. Dale and Schultz observed that when the excised uterine strip of a sensitized animal is immersed in a warm bath of Ringer's

solution, it will contract upon the addition of the minutest amount of the suspected antigen. A graphic record will show the degree of sensitivity.

An effort was made in this presentation to discuss various items with which a technician previously trained for general laboratory work should be acquainted before qualifying for work in an allergy laboratory and clinic.

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THE MEDICAL TECHNOLOGIST IN INDUSTRY*

By B. ANITA WEST

E. I. DuPont De Nemours & Co. Medical Division, Wilmington, Del.

I have chosen this subject because of the growing importance of industrial medicine and hygiene, and the part the technician stands to play in that sphere.

Too many of us are prone to think of industry in terms of some isolated manufacturing plant sprawled over several acres of ground on the outskirts of some city. We do not know, or fail to realize, that in the world of tomorrow many things we do will have their occupational hazards.

It is to the advantage of the employer to keep the trained worker on the job. Out of this desire has grown a system of physical examination of employees. This system, in conjunction with the United States Department of Health provides statistics needed for the survey and safeguarding of the various occupational groups.

Statistics show that 50% of those reported as having some chronic disease, fall into the group under 45 years of age. When you consider this, you begin to realize the value of discovering disease in its early stage, before an individual seeks a doctor. Since industry reaches into every walk of life its influence upon the future health of the country is invaluable.

To make the term "industry" a bit more comprehensive, let us think rather of the large department store, the telephone company, the paper mill, the steel mill, the rubber plant, the mining of coal, gold, and silver: of the manufacture of clothing in all its phases of spinning, weaving, and dyeing; of the production of gasoline and other allied oil products; of the realm of chemicals and the production of all the thousands of things that make for progress and luxury. Even agriculture has its occupational hazards. To put it simply, the industrial world is our working world.

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* *Read before the Eighth Convention of the American Society of Medical Technologists, New York, N. Y., June, 1940.*

Industrial medicine utilizes the services of physicians, technicians, and nurses, in the diagnosis and treatment of the sick and injured, but it also incorporates the services of bacteriologists, chemists, and engineers, to see that working conditions are made safe. The size of the medical staff depends not so much upon the number of employees, as upon the type of work and the materials handled. One readily understands that the examinations required by office workers would not be as frequent as those required by the same number of people engaged in the manufacture of some poisonous chemical.

Employment examinations and periodic check-ups give an estimate of the physical fitness of the worker and helps to educate him in the value of health. By catching an early stage of disease or irritation he is guarded against future disablement and loss of time from his job.

This system of check necessitates a steady flow of humanity through the medical department. Each of these gets some form of laboratory or X-ray test. It means a vast load is carried by the laboratories, an important task too, because many times the laboratory reports call attention to conditions not shown in physical examination.

Let me here say that the clinical and X-ray laboratories are indispensable to each other in this type of work, and the technician who is trained in both of these professions is invaluable to her employer.

The technician becomes the right hand of the examining physician. The industrial hospital may have a small ward, but as a rule only first aid cases are cared for and even these are not kept more than twenty-four hours. The work is done upon ambulatory patients, and the task is to get them through the laboratories and back on the job. The technician needs to be versatile and tactful, probably more so than in any other position, otherwise many employees may resent these examinations.

Most of the work performed comes under the heading of routine tests, meaning blood counts and urinalyses. Next in line are blood sugars, ureas, uric acid, carbon dioxide combining power, kidney function tests, liver function tests, sputum examinations, sedimentation tests, and various bacterial smears. In addition, depending

upon the materials handled, there may be a call for almost any test such as quantitative estimation of mercury in urine, aniline in urine, phosphorus, hydrogen-ion in blood or urine, chlorides, CO_2 calcium, typing, blood culture, identification of fungus, malarial examinations, examinations for sickle cell anemia. Vast numbers of blood slides are examined for stippling.

As I have stated the clinical and X-ray laboratories complement each other. Films of bones are made for fracture, disease, or to note deposits of calcium or degeneration from any cause; soft tissue films are made for infections and to locate foreign bodies; chest plates are routine and all respiratory diseases get frequent checks; sinus and teeth films are made to locate foci of infection; films of kidneys for stones or with intravenous dye to test function and outline the genito-urinary tract; these and many other films help to present a visual record. The technician adds greatly to her, or his, knowledge of anatomy and physiology and is thus enabled to grasp the significance of new problems as they arise.

To those of you accustomed to hospital, clinic, or office, the thought might occur that all this work would become monotonous to the technician. There is a vast amount of clerical work involved, accurate records must be kept, cross index files must always be up-to-date. There are daily, monthly, and yearly reports to be handed in, and no clerk can keep as accurate a record of many things as the technician who does the work. Likewise the majority of our tests are within the limit of normal values.

Speaking as one who has had about equal experience in hospital and industrial laboratories, I do not believe the work tends to monotony. The day is filled with swift moving routine and new problems keep coming up. Every new product must be closely watched and it is the faintly positive test that we look for. Since we are in the ideal position of being able to contact the patient when desired, we obtain some interesting follow-up records.

We have watched the blood changes in a case of acute myelogenous leukemia from its first detection to its fatal termination; we have followed a case of infectious mononucleosis through its course. We have seen tuberculosis from its first visible lung changes to calcification. We have seen a case of pneumonia when the patient

first complained and his lung fields showed the faintest of clouding, and later when he had returned to work, noted how long it took for his lungs to clear.

You have all heard of lead poisoning, but the industrial technician sees a picture that predates the classical ones in the textbook. She follows the very first warnings of bone marrow irritation. The same is true of mercury. She sees the first warning in the small tubular cell in the microscopic urine, the trace of albumin or the constant reduction of copper in Benedict's solution.

We learn about aniline, a coal tar derivative and found wherever dyes are produced. It is readily absorbed through the moist skin and forms a permanent combination with the iron in the hemoglobin molecule. This prevents the distribution of oxygen and the result is cyanosis and coma.

At the time of coma the blood count may be normal although methemoglobin is present. Two to three days later a severe anemia may result, hence the need for follow-up examination until the danger period is over.

Frequent tests for carbon monoxide are made on the workers exposed to this gas. Often this is carried out at the place of work because an individual may grow accustomed to small amounts of carbon monoxide in his blood and not show the usual symptoms.

Through blood pictures and chest films some very interesting records are obtained of the early changes in respiratory diseases. Wherever mining is done, or workers engaged in sand blasting, whereever emery stones are used or dust encountered, as well as occupations where the workers are exposed to chemical fumes, the lungs must be studied for possible fibriotic changes.

When we inhale tiny particles of dust they are walled off in the lungs by a process of fibrosis. Inhalation of fumes may produce the same reaction. Continuation of exposure may affect the normal lung activity and so render the individual doubly susceptible to bacterial invasion. In our employment examinations we sometimes find beautiful pictures of fungus growth in the lungs.

In the early stages there may be no symptoms and the workers are unaware of their condition. By detecting these changes at a time when they may be arrested, and removing the worker from

dangerous areas, he can be protected against a later invalidism.

Diabetes is another widespread disease picked up in the periodic examination. Urinary sugar may be the only indication, yet a subsequent blood sugar show as high as 300 mgs. of glucose. Warned and advised about diet, benefited by frequent laboratory examinations, many hundreds of men and women may be saved the misery that would ensue had they waited for symptoms to send them to a doctor.

Anemia is another problem. Thousands of people have some form of secondary anemia. Environment and malnutrition are greater causes than occupational hazards. Occupations that may affect the blood cells are so closely watched, and the workers so closely checked that they present one of the healthiest of groups. That is why a blood count now becomes a part of the yearly examination of the office worker as well as the chemist. An elevator operator with a hemoglobin of 6.5 gms., and a red count of 3,000,000, might become as much of a hazard as the man, handling a highly explosive material, and who has a blood sugar of 300 mgs.

Now a few words about the value of the industrial world in the control of syphilis. In the company for whom I work, as is now the policy of many, every new employee gets a Kahn. This is checked each year, more often if positive. While not barred from employment, the man with a positive test is barred from certain areas and he must have treatment.

Last year our central sereological department, conducted by one technician and a laboratory helper, ran thirty-five thousand Kahns. All suspicious, positive, and treatment cases were checked with a Kline.

When you consider that these people would never have gone to a doctor or clinic for such a test, you can see the value to the country in thus helping combat this disease.

It is a task to attempt to picture for you an industrial laboratory. Sometimes there is a nurse who combines the duties of first aid and laboratory. There may be one technician or there may be five or six. Thousands of people pass through our doors each year. It is hard work but systematic. Technicians learn the great lesson of co-operation with each other, as well as with other departments and

the patients. Four technicians could not perform thirty-five thousand laboratory tests and take care of three thousand X-ray cases in a year without such co-operation. This is on a basis of forty hours a week.

The laboratory must be ready to perform any request when asked. In addition to employment and regular examinations there are many requests from the first aid departments. There is a steady stream of minor burns, cuts, abrasions, infections and illnesses, as well as serious accidents. The technician helps with photography, electrocardiographs, electrotherapy and light therapy, and any other odd jobs that may occur.

Industrial companies demand that their technicians have good training, many have degrees. It is the policy of the Dupont Medical Department to urge its technicians to become registered and to attend meetings and institutes so they may be versed in all new procedures.

We have our libraries, our research departments with their bacteriologists, toxicologists, pathologists, chemists, and technicians, to aid us when a problem arises. New apparatus to facilitate and add to the accuracy of the work is provided. For the past fifteen months in our central laboratory we have been using a photoelectric colorimeter for counting red blood cells and estimating hemoglobin. On several thousand cases it has proved as satisfactory as the old method of counting and saves valuable time. We also use an eriometer for estimating the diameter of the red cell.

In the industrial world, the medical unit is non-productive and expensive. It justifies itself by the illnesses it prevents. The records compiled as a routine procedure by the technicians, tabulated by statisticians, and proved by time, will have their part in the contribution of industrial medicine.

ABSTRACTS

THE RED BLOOD CELL AS A SOURCE OF THE IRON AND BILIRUBIN OF THE BLOOD PLASMA: G. Barkan and B. Walker, Jr. Biolog. Chem., Vol. 131, No. 2, Dec. '39, p. 447.

Iron and bilirubin determinations were carried out on fresh blood plasma and on plasma which had stood in contact with the red blood cells. Evidence is presented to show that the disintegration occurs in the cells and the products are transferred to the plasma.

Since enzyme inhibitory substances failed to retard the process, the encyme theory of von Czike is not supported.

A METHOD FOR THE DETERMINATION OF BLOOD ACETONE BODIES: R. H. Barnes and A. N. Wick, Jr. Biolog. Chem., Vol. 131, No. 2, Dec. '39, p. 413.

This method uses sulfuric acid and potassium dichromate to oxidize acetoacetic acid and -hydroxybutyric acid to acetone, precipitating this acetone as a mercury compiex and purifying it by centrifuging. This is then decomposed by HCl and the acetone is distilled, collected in alkaline iodine and titrated by the Messinger technique.

STUDIES ON THE CULTIVATION OF THE VIRUS OF LYMPHOGRANULOMA VENEREUM: M. Sanders, Jr. Exp. Med., Vol. 71, No. 1, Jan. '40.

The tissue culture media used are described. Two strains of the virus were maintained 12 and 21 generations respectively. Better results were obtained at room temperature than at 37° C.

A RAPID PHOSPHATASE TEST: R. Aschaffenburg and F. K. Neave, Jr. Dairy Res., Vol. 10, No. 3, Sept. '39.

This method involves an adaptation of Scharer's method. The test can be completed in 1½ hour. Factors influencing its reliability are discussed. Abnormally high results are reported on pasteurized milk from cows suffering from mastitis.

THE EFFECT OF LIGHT ON THE VITAMIN C OF MILK IN DIFFERENT CONTAINERS: J. Houston, S. K. Kon & S. Y. Thompson, Jr. Dairy Res., Vol. 10, No. 3, Sept. '39.

Under the influence of light the vitamin C content is known to diminish rapidly. Observations on commercially available containers showed little destruction in brown glass, more in green glass and still more in wax impregnated cartons but, nevertheless, the carton conserved about twice as much as a clear glass bottle.

NOTE ON AGGLUTINATION REACTIONS IN THE TYPHOID CARRIER STATE: J. R. Murray, F. Partner, Jr. of Mental Science, Vol. 85, No. 354, Jan. '39, p. 126.

Of 25 enteric carriers studied, 11 (44%) gave Widal reactions which were negative or within normal even tho typhoid organisms could be isolated at the time. Only 14 gave serum reactions of diagnostic significance.

UNUSUAL TYPES OF TYPHOID INFECTIONS: III, P. T. Lantin, N. Mendiola, S. Morales, M. Ramos. Jr. P. I. Med. Ass., Vol. 19, No. 10, Oct. '39, p. 603.

Report of a case of typhoid occurring 7 days after an apparently normal delivery. WBC 25,250 with 86% neutrophiles. Blood culture was positive for B. typhosus three days after admission. Death occurred 5 days after admission and the autopsy disclosed no intestinal lesions but multiple abscesses of the lungs and kidneys and a fibrinous pericarditis. Cultures from these were positive.

THE INFLUENCE OF DISULFANILAMIDE ON EXPERIMENTAL INFLUENZA INFECTIONS: D. R. Climenko, M. L. Crossley & E. H. Northey, Jr. Pharm. & Exp. Ther., Vol. 67, No. 2, Oct. '39, p. 201.

The authors report they could inactivate influenza virus with sodium disulfanilamide in vitro and also that this drug exerts a protective action against moderate infecting doses of the virus.

BOOK REVIEWS

A TEXTBOOK OF HISTOLOGY by Harvey Ernest Jordan, A.M., Ph.D., Professor of Anatomy and Director of the Anatomical Laboratories, University of Virginia. Eighth edition, 690 pp., 609 figures. Price $7.00. D. Appleton-Century Co., 35 West 32nd Street, New York.

This eighth edition since 1916 maintains the same conciseness of text as the previous editions. Important additions to recent literature and many new illustrations have been incorporated. There are one or more illustrations on almost every page, some in color, all designed to clarify and supplement the text. Histology has kept pace with advances in other branches of medicine and the literature on this subject has been especially abundant in the past decade. The more important advances have been included in the text and thorough revision has been made of the chapters on Muscle, the Endocrine Organs, the Female Reproductive System, the Blood and the Blood Vascular System. Histology is one of the foundation stones upon which other medical subjects are built and the material is admirably presented by the author who has had many years of teaching experience in this subject.

TEXTBOOK OF BIOCHEMISTRY: By Benjamin Harrow, Ph.D., Professor of Chemistry, City College, College of the City of New York. Second Edition, Revised. 439 pages with 88 illustrations. Philadelphia and London: W. B. Saunders Company, 1940. Cloth $3.75.

Harrow has presented his subject matter in a most fascinating and stimulating manner. To a clinician the tremendous possibilities of future practical application of the many facts recently discovered by numerous biological chemists are strikingly revealed. To all whose work is confined to the laboratory the way is pointed to the untold number of facts waiting to be discovered. One by one the secrets of the intricate biological processes are being discovered and laid before us to be fitted into the constantly changing mosaic pattern of highly complicated organic and inorganic chemical reac-

tions which are designated as animal life. One small but important phase of this work, for example, is presented by the author in his chapter on the metabolism of the lipids, namely, the work of Schoenheimer in attaching heavy hydrogen as a "label" to the compound under examination then fed to animals and its course in the body traced by determining this heavy hydrogen in the various tissues. This at once offers many possible ramifications. Much other new and important material has been added such as Stanley's work on mosaic-diseased tobacco plants; the chemistry of the various vitamins, their use by the body and clinical application; Northrop's purification of bacteriophage with a chart showing the relative sizes of several selected viruses, including bacteriophages, in molecules and others; sulphanilamide and sulfapyridine; the use of the nitrogen isotope in the study of protein metabolism; Kögl's work on d-glutamic acid and tumor tissue; and the newer conceptions of coenzymes and carriers in biological oxidation. New material has been added to the chapters on foods, detoxication, blood and hormones, the structure of proteins, Ivy's investigations into secretin and others.

BACTERIOLOGY IN NEUROPSYCHIATRY: A Survey of Investigations Concerned with the Specific Role of Infectious and Immune Processes by Nicholas Kopeloff, Ph.D., Research Bacteriologist, New York State Psychiatric Institute and Hospital, New York. 316 pages, 1189 references. Charles C. Thomas, Publisher, 1941, Springfield, Illinois; Baltimore, Maryland. Cloth $4.50.

This work tersely presents the contributions which bacteriology and immunology have made to the study of nervous and mental disorders. Inasmuch as the literature on this subject is widely scattered through many languages the book will be found of great value to those interested in this field. Worthless and dubious claims are omitted. Part I takes up the diseases of known etiology with primary involvement of the nervous system and includes syphilis, epidemic cerebrospinal meningitis, encephalitis, herpes, rabies and anterior poliomyelitis. Part II is concerned with diseases of known etiology with secondary involvement of the nervous system due to direct invasion, to neurotoxins or to toxic or other factors. Under the first are included brain abscess, tuberculosis, leprosy and the

diseases caused by rickettsia, spirochetes, viruses, protozoa, helminths and anthropods. Under the second are discussed such neurotoxins as tetanus, diphtheria, botulism and dysentery. Under the latter the pyogenic cocci of scarlet fever, erysipelas, etc., and gram negative bacilli of typhoid, whooping cough and others are given their full significance. Part III dealing with diseases of unknown etiology involving the central nervous system is interesting from the standpoint of speculation and certainly leaves much to be desired in the way of well controlled research. The functional psychoses where structural changes are not established and diseases of probable infectious origin are considered. In Part IV immunology of the central nervous system is discussed and includes such topics as hypersensitiveness, anaphylaxis, allergy, the nervous system as an antibody producer and immunologic studies. A summary is given at the end of each chapter which is convenient for a quick reference.

LABORATORY MANUAL OF BIOCHEMISTRY: By Benjamin Harrow, Ph.D.; Gilbert C. H. Stone, Ph.D.; Ernest Borek, Ph.D.; Harry Wagreich, Ph.D.; Abraham Mazur, Ph.D. Chemistry Department, City College, College of the City of New York. 119 pages with 19 illustrations. Philadelphia and London. W. B. Saunders Company, 1940. Paper $1.50.

By providing simple experiments, this loose-leaf Laboratory Manual is designed for any of the standard textbooks on biochemistry but is particularly well adapted to the author's "Textbook of Biochemistry." Precise directions are given for all experiments. Useful questions are placed after nearly all experiments. The usual experiments on carbohydrates, lipids, proteins, enzymes and others are given and in addition some of the more recent procedures are included such as the application of photochemistry, sulfapyridine determination and the uses of chromatographic analysis. The manual is illustrated with a few drawings of various laboratory apparatus and instruments. The two outstanding features which recommend the manual to students and technicians are (1) the thorough manner in which directions are given for the conduct of each experiment and (2) the valuable questions at the conclusion of each.

TABER'S CYCLOPEDIC MEDICAL DICTIONARY: Including a Digest of Medical Subjects: Medicine, Surgery, Nursing, Dietetics, Physical Therapy. By Clarence Wilbur Taber and 14 Associates. 1488 pages with 273 illustrations; Philadelphia: F. A. Davis Company, 1940. Cloth, Thumb-indexed $3.00, Plain $2.50.

Fourteen medical specialists collaborated with the editor to make this work authoritative and up-to-date in every respect. The dictionary contains over 50,000 medical words in all branches of medicine and 273 illustrations. There are about twenty new features which become apparent the more the dictionary is used and all are helpful or convenient. A few of these may be mentioned. The names of over 600 drugs, including new and non-official remedies, are given with uses, action and dosage. All the important poisons are given with symptoms, antidotes and first aid treatment as well as the treatment of bites, stings, fractures and other accidents. Many terms used by the laity are included with their medical equivalents. Hundreds of important tables are given in the text. There are over 370 questions to ask a patient in five different languages. The claim is made that this dictionary contains more etymologies than large unabridged medical dictionaries and as the result of original research they have a great degree of accuracy. Practically every food and beverage is listed with many facts about each. Other features too numerous to mention make this an outstanding medical dictionary.

NEWS AND ANNOUNCEMENTS

The following is an editorial which we have translated from "FINLAY," official publication of the National Association of Laboratory Technologists of the Republic of Cuba, Vol. 1, No. 1.

EDITORIAL

OUR GREETINGS

With the arrival of the New Year, we take this opportunity to send our greetings with profound respect and affection to the Medical Profession of Cuba, especially to our dear masters and professors, the Laboratory Doctors who with their knowledge of science and teachings have guided our first steps and also have created a wide field in Medicine, one more profession among its allies, the Laboratory Technicians; it is to them, therefore, to whom we convey our most sincere respects. Our greetings are also extended to all the Laboratory Technicians of the Republic of Cuba, allied workers in Medicine, who so loyally and sincerely have come to our organizing call and who, collaborating in many ways, have succeeded in making our Association very strong, and also have contributed in the improvement of our scientific and social standards.

We, also, extend our greetings to our friends abroad, especially those of the American Continent and very particularly to the members of the *American Society of Medical Technologists of the United States of America*, who with their encouraging words and friendly advices have contributed in giving strength to our spirit of going forward. We, also, wish to have our greetings reach the allied profession, namely, Nurses, Midwifes, Optometrists, etc., who from the beginning of our Organization have been loyal and sincere collaborators.

May this message, also, serve to strengthen our fraternal spirit which unites all the professions allied to Medicine, and in God we

trust that during the year just beginning, we will see crystallized in a definite manner, the maximum aspiration of our Organization: "The establishment of a National School for Laboratory Technicians."

THE DIRECTOR.

We of the American Society of Medical Technologists and the Editorial Staff of the *American Journal of Medical Technology* offer our salutation and sincere co-operation to the Cuban Society of Laboratory Technologists in the spirit which has so graciously been given. This spirit of friendliness between neighbors is one to be cherished in these troublous days.—*Editor of the American Journal of Medical Technology.*

Dr. Philip Hillkowitz, former chairman of the Registry of Medical Technologists, and Mrs. Anna R. Scott, former registrar, who have recently relinquished their respective posts, take this means of thanking the numerous friends among the pathologists and the registrants who have written them letters of appreciation.

We call your attention to the hotel reservation form at back of *Journal* which should be immediately filled in and sent to the Cleveland Convention & Visitors' Bureau, Inc., if you plan attending the annual meeting.

We have just received an advance copy of "The Bloodless Phlebotomist," Vol. VIII, No. 6, which is usually issued in 15 languages with a total circulation among members of the medical and allied professions throughout the world of 1,500,000 copies. This year, however, due to the War, it will be sent to members of the professions only in English, Spanish and Portugese speaking countries outside of the War zone.

If you do not receive a copy write to the Denver Chemical Mfg. Company, New York, who will place your name on their list. The journal will be supplied you free of all charges.

Ohio

The Ohio Society of Medical Technologists will meet April 30, 1941, at The Deschler Wallick Hotel in Columbus, O. We want every Technologist to try to attend.—Edna M. Rigdon.

Illinois

The winter meeting of the Illinois Society of Clinical Laboratory Technicians was held Friday, January 31, 1941, in Northwestern University Medical School, Chicago, Ill.

Program—Symposium on the Gastro-Intestinal Tract:

"Physiology of the Gastro-Intestinal Tract," K. K. Jones, M.D., Department of Physiology, Northwestern University Medical School.

"An Evaluation of Gastric Functional Tests," A. A. Goldsmith, M.D., Wesley Memorial Hospital, Chicago.

"Feces Cultures," Mr. D. M. Rudig, Senior Bacteriologist, Chicago Health Department.

"Laboratory Procedures for Determination of Blood Lipase and Amylase," Miss Ida Kraus, Ph.D., Chemistry Laboratory, Cook County Hospital, Chicago.

REPORT OF THE FIRST ANNUAL MEDICAL MEETING OF THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

The National Foundation for Infantile Paralysis held its First Annual Medical Meeting at the Waldorf-Astoria Hotel, New York City, on November 7 and 8, 1940. Attending the meeting were the members of the medical advisory committees, the grantees of the Foundation, and the Board of Trustees. Reports of the activities of committees and grantees for the preceding year were presented, and recommendations were made for grants for 1940-1941.

The Foundation is concerned with promotion and furtherance of research on all phases of infantile paralysis. Studies are being carried on through grants from the Foundation on problems of epidemiology, virus research, relationship of nutrition to poliomyelitis, and the prevention and treatment of the disease. In addition, a program of professional and lay education has been promoted.

Research on the Virus

The Committee on Virus Research reported that studies were being conducted to determine the nature of the poliomyelitis virus. Paul F. Clark, Ph.D., the University of Wisconsin, has concentrated the virus infected material obtained from spinal cords of monkeys so that infection may be produced in dilution of one part to ten million. Dr. Hubert S. Loring, Leland Stanford University, who has been studying the purified and concentrated virus, concluded that the virus is protein in nature, or contains protein material. The properties and chemical nature of the virus will continue to be studied.

Drs. John R. Paul and James D. Trask, Yale University School of Medicine, reported the finding of the poliomyelitis virus in stools of patients, contacts, and in sewage collected from epidemic areas. Dr. S. D. Kramer, Michigan Department of Health Laboratories, reported the occurrence of healthy carriers in an institutional outbreak in Detroit. Karl F. Meyer, Ph.D. and Beatrice Howitt, The George Williams Hooper Foundation of the University of Califor-

nia, conducted detailed laboratory studies of material collected from patients, contacts, and the environment during an epidemic in Tacoma, Washington.

Reports were made of the efforts to produce infection with poliomyelitis viruses in animals other than the money. This confirmed the previously reported findings of Armstrong to the effect that the Lansing strain could be made to produce infection in various cotton rats. All investigators, excepting Dr. John A. Toomey of the Western Reserve University School of Medicine, reported that only this one strain could be made to produce disease in the cotton rat. Toomey, however, had success in growing, by a special technique, several other old as well as newly isolated strains in the cotton rat. This observation may be of the utmost importance in conducting further clinical and epidemiological studies.

The distribution of the virus in the body was reported by Drs. R. D. Lillie, The National Institute of Health in Washington, Albert B. Sabin, University of Cincinnati, John F. Kessel, University of Southern California, and others. All showed that the virus could be routinely recovered from central nervous tissue of human fatal cases and from experimental animals, and that excepting for tonsils, adenoids, and lymph gland tissue, no other part of the body was shown to harbor the infection.

Studies of Immunity

Studies on the development of active and passive immunities were reported. *All attempts at producing immunity have thus far met with failure.* Dr. Kessel reported that one infection did not routinely protect monkeys from subsequent disease on reinoculation. He also made the observation that there was but little relationship between the presence of neutralizing antibodies in the blood stream and immunity to the disease.

Chemotherapy

Studies in chemotherapy were reported by C. C. Young, Ph.D., and Dr. S. D. Kramer of the Michigan Department of Health Laboratories. While they have not found a chemical that will do for poliomyelitis what sulfanilamide has done for certain bacterial infections, leads have been discovered which are now the subject of further investigation.

Investigations of After Effects

Reports were received from grantees who are studying both the effects of the disease and the methods of prevention of damage. Dr. Donald Young Solandt, University of Toronto, concluded that the muscular fibrillation resulting from nerve destruction is not the primary cause of atrophy of paralyzed muscle. Dr. Clinto N. Woolsey, Johns Hopkins University School of Medicine, concurred in these results, but Dr. Samuel Soskin, Michael Reese Hospital in Chicago, felt that in the animals which he studied fibrillation did play an important part in the degree of atrophy resulting from nerve destruction.

Physiological changes in muscular atrophy are being studied by Dr. I. Arthur Mirsky at the Jewish Hospital in Cincinnati, by Dr. A. T. Milhorat at the Russell Sage Institute for Pathology in New York, and by Professor Harry M. Hines at the State University of Iowa. None of these has pursued the investigations far enough to warrant any definite conclusions.

Gross and microscopic pathological studies of paralyzed muscles carried on by Dr. Herbert E. Hipps, The Crippled Children Hospital in Marlin, Texas, showed that occasionally muscles developed a band like form of degeneration, and that when mattress sutures were used to connect the muscle above and below these bands, good functional results were obtained.

Several instruments were presented for the more accurate testing of muscle strengths. Dr. A. A. Schmier, The Hospital for Joint Diseases in New York City, developed a muscle tester and recording apparatus suitable for measuring in pounds and ounces the pulling power of most of the muscles of the body. Dr. Leo Mayer of the same hospital has developed a table designed to evaluate in the same terms the muscle power of the trunk.

Surgical Treatment

Several studies have been completed and others are still being conducted that measure the end results of various forms of surgical and conservative treatment. Drs. George E. Bennett and Raymond E. Lenhard, The Children's Hospital School in Baltimore, concluded that if the maximum benefits of physiotherapy are to be

secured patients must be under such care within six months of the onset. They further showed that 97 per cent of all weakened or paralyzed muscles regain the maximum possible strength within eighteen months after onset of treatment. Dr. William B. Carrell, Texas Scottish Rite Hospital in Dallas, confirmed these observations. In addition, he concluded that rest with physiotherapy in the hospital had no advantage over similar treatments given in the home. Hospital care over long periods was of decided advantage only when underwater treatments were used. Dr. Carrell also pointed out the disadvantages of plaster casts continued over periods of from four to six months, even when the patients reported for frequent reapplications of the casts.

The value of rest treatment was further emphasized by laboratory studies on infected monkeys. Dr. Sidney O. Levinson, The Michael Reese Hospital in Chicago, showed that monkeys forced to exercise during the active disease process had not only a greater amount of paralysis but also a higher death rate.

Much work has been done on study of bony deformity, such as scoliosis and unequal leg lengths, resulting from infantile paralysis. Since years of observation of individual patients are necessary, only progress reports could be made at this meeting.

Epidemiology

Reports were rendered on the activities of the Foundation in epidemic areas. It is not the purpose of the Foundation to provide medical care to patients, yet it has rendered certain assistance to communities and hospitals by supplying splints, Bradford frames, and by making respirators available. Studies of epidemics were made in a few areas upon the request of and with the consent of the health officers. These studies have progressed only far enough to point the way for more than elaborate and exhaustive work of the future.

Educational Activities

To inform both professional workers and the public of certain aspects of this disease an educational program has been conducted. An exhibit at the New York World's Fair was viewed by over five million persons. Scholarships have been made available through the National Research Council to physicians wishing to specialize

in orthopedic surgery or virology. Other scholarships have been made available to nurses wishing to specialize in the orthopedic aspects of public health nursing. Graduate instruction in physiotherapy also has been provided.

Booklets have been prepared and widely distributed dealing with the use of the respirator, the nursing care of poliomyelitis patients, and other phases of the problem.

Scientific investigation of the possible relationship existing between the state of nutrition and the development of infantile paralysis has been undertaken. It was not deemed expedient to limit these studies to poliomyelitis, but rather to include the entire field of infectious diseases.

At this meeting additional grants were recommended for continuation of existing studies or new investigations in the amount of $137,350.00.

As the result of elections, the following chairmen of medical committees were appointed:

The Committee on Virus Research:

Thomas M. Rivers, M.D., Director of The Hospital of The Rockefeller Institute for Medical Research, New York City.

The Committee on Research for the Prevention and Treatment of After-Effects:

Philip Lewin, M.D., Associate Professor, Orthopedic Surgery, Northwestern University Medical School, Chicago, Illinois.

The Committee on Nutritional Research:

James S. McLester, M.D., Professor of Medicine, University of Alabama School of Medicine, Birmingham, Alabama.

The Committee on Epidemics and Public Health:

Herman N. Bundesen, M.D., Commissioner of Health, Chicago, Illinois.

The Committee on Education:

Max M. Peet, M.D., Professor of Surgery, University of Michigan Medical School, Ann Arbor, Michigan.

The Committee of Medical Publications:

Morris Fishbein, M.D., Editor, The Journal of the American Medical Association, Chicago, Illinois.

CLEVELAND, THE CONVENTION CITY

THE CLEVELAND MUSEUM OF ART

One of the outstanding attractions in Cleveland, where the annual convention of the American Society of Medical Technologists is to be held in June, is the Cleveland Museum of Art, which is in the vicinity of Wade Park Manor, Convention Headquarters. While no special trip will be made to the Museum of Art while the convention is in progress, every member is urged to make his way there before he leaves the city. He will be well repaid for his effort.

The white marble building of The Cleveland Museum of Art, opened in 1916, stands in Wade Park with the Fine Arts Garden as an approach. The world-famous collections which it houses are representative of the arts of all countries and periods, from ancient Egypt down to contemporary Cleveland.

Among the important collections are the Colonial and Early American portraits, the recently acquired Hollis French collection of Early American silver, The Holden Collection of Early Italian and other primitive paintings, the Severance Collection of Arms and Armor, magnificent medieval ivories, enamels and goldsmith's work, including fourteen objects from the famous Guelph Treasure of medieval ecclesiastical art. There are also magnificent collections of laces, Indian pottery, jewelry, costumes, etc., Oriental and Egyptian arts, a collection of eight Digo and Aeneas tapestries woven in the Barberini Palace in Rome in the seventeenth century; sculptures, prints, old master paintings, water colors, jewelry, and almost every other conceivable type of art.

"The Holy Family with St. Margaret and St. John," a large tondo painting by Filippino Lippi, which dominates the rotunda, is the greatest single accession ever made to the Museum, and was presented in memory of Delia E. Holden by members of her family. This is not only one of the masterpieces of this late 15th-century Florentine artist, but it is one of the greatest Florentine paintings in America.

"La Danse dans un pavillon," by the French artist, Jean Antoine Watteau, which was presented in 1938 by Commodore Louis D. Beaumont, is classed as another of the three most important accessions to the Museum, the third being the Guelph Treasure collection. This painting was purchased for Frederick the Great and remained in the Imperial German collections until after the World War, eventually passing into the hands of Lord Joseph Deveen, from whom it was purchased by Commodore Beaumont.